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Review Article

# Effect of Coffee, Tea and Milk on Various Visual Parameters after Prolonged Laptop Viewing

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**Abstract**

**Background:** In today's digital age, prolonged screen use has become common, affecting various visual functions. Coffee, tea, and milk are widely consumed beverages known to have potential health impacts. This study aimed to assess their immediate effects on visual parameters following extended laptop use.

**Methods:** A prospective cohort study included twenty healthy adults aged 18 to 35. Ethical approval was obtained, and participants gave informed consent. Baseline visual assessments were conducted after three hours of laptop use. Participants consumed 100 mL of coffee, tea, or milk on three consecutive days, and visual metrics were evaluated at 30 minutes and 60 minutes post-consumption. Standardized optometric tests were employed, and the data were analysed using SPSS 21.0, including MANOVA and linear regression.

**Results:** Twenty female participants (mean age: 20.6 years ± 0.753) underwent visual assessments after consuming coffee, tea, and milk. After 30 minutes of coffee intake, contrast sensitivity increased from 1.60 to 1.75 logs ($P = 0.026$) but declined to 1.59 logs after 60 minutes ($P = 0.016$). Coffee notably affected near-point convergence with a red filter, decreasing from 10.40cm to 10.55cm at 30 minutes and to 10.78cm at 60 minutes ($P = 0.000$). Tea consumption showed a significant change in deutan color vision ($P = 0.034$) between 30 and 60 minutes, while no statistically significant alterations were observed for milk. Simple linear regression indicated no significant impact of beverages on visual parameters over time ($p > 0.05$).

**Conclusion:** This study delineates the transient effects of coffee and tea on visual parameters, showing temporary improvements in contrast sensitivity and colour vision within 30 minutes, subsiding after 60 minutes. Both coffee and tea induced a clinically significant increase in accommodation amplitude while causing a regression in near-point convergence, contrasting with milk consumption, which led to decreased visual parameters due to tryptophan's presence inducing drowsiness.

**Keywords:** coffee; tea; milk; contrast sensitivity; accommodation; convergence

## Introduction

Practically all professional and recreational activities in the twenty-first century require the use of digital displays. The computer has evolved into a ubiquitous fixture in every household. An approximated 35 % of individuals consult their mobile devices prior to utilising provisions such as coffee, toothbrushes, or other necessities. An earlier study found that the mean daily time devoted to electronic display viewing is approximately 9.7 hours for adults and 7.5 hours for adolescents. [1] Extended periods of stationary posture can deplete an individual's energy, and the body may associate such stillness with the onset of slumber. Energy refreshments such as coffee, tea, milk, and others provide them with a revitalized sensation. Coffee and tea are beverages that are significantly consumed by adults on a global scale. Coffee is widely consumed, and the rate of consumption continues to rise. The bioactivity of coffee's complex chemical compounds is accountable for its invigorating and revitalizing properties. [2] Similarly, tea is the most widely consumed beverage in the globe, second only to water. Research has demonstrated that the cholinergic acids present in coffee beans, flavan-3-ols, complex theaflavins, and thearubigens found in tea leaves all have positive effects on health. To determine the diverse health advantages of these beverages, an examination was conducted on their abundant phenolic compound content. Caffeine, vitamins, minerals, polyphenols, and additional constituents found in coffee all contribute to its numerous health benefits.

Tea is beneficial to consume due to the polyphenols, catechins and epicatechins, which are present in tea. [3]

Coffee and tea consumption has been linked in multiple studies to a decreased risk of cardiovascular disease and stroke. [4, 5] The presence of polyphenols in coffee and tea aids in mitigating the risk associated with the above. A profusion of the antioxidant cholinergic acid enhances glucose metabolism, thereby impeding the production of advanced glycogen end products and, as a result, reducing the long-term risk of developing type 2 diabetes. Antioxidants found in tea assist the body in metabolizing glucose in the blood. [6] Caffeine may alleviate the initial symptoms of Parkinson's disease, according to some studies, while coffee and tea consumption may provide some protection against the disease, according to others. [7]

A previous study found a direct relationship between increased coffee intake and elevated intraocular pressure.[8] Nevertheless, the impact of coffee and tea on additional visual parameters is not yet understood. Therefore, the objective of this research was to determine the immediate impact of coffee, tea, and milk on various visual parameters, including contrast sensitivity, convergence, accommodation, and visual acuity, subsequent to extended periods of laptop usage. It was hypothesized that, as stimulants, coffee and tea would enhance performance in all visual parameters, whereas milk would diminish it.

**Methodology**

The purpose of this study was to investigate the potential impact of beverage consumption on several visual metrics following prolonged laptop usage among a group of twenty healthy adults ranging in age from 18 to 35. The study was designed as a prospective cohort study. A simple random sampling approach was utilized in order to pick the participants for the study. This was done in order to guarantee that the cohort was represented in an objective manner. For the purpose of ensuring ethical compliance and upholding the ethical standards that were set in the Declaration of Helsinki, the protocol for the study was given formal approval by the institutional ethics committee that is in charge of reviewing research involving human subjects. It was ensured that every participant gave their written informed consent, confirming that they participated voluntarily and that they were aware of the objectives and procedures of the study. In addition, before the beginning of the examination, participants were given a detailed description of the examination protocol to guarantee that they were aware of every detail and gave their agreement after being sufficiently informed. Taking into consideration the potential influence that prolonged screen exposure during this time period could have on visual health, the evaluations of visual parameters were planned to take place throughout the evening hours. This was done in order to imitate a common scenario of prolonged laptop usage. Visual acuity, convergence, accommodation, contrast sensitivity, and colour vision were some of the elements that were included in these criteria. These comprised a wide variety of variables that impact visual function.

A minimum of three hours of laptop use was required of each participant before the execution of the visual assessments. After the subjects had been using their laptops for a lengthy amount of time, they were subjected to routine optometric tests in order to evaluate their visual acuity, convergence, accommodation, colour vision, and contrast sensitivity. The tests were designed to correctly capture the baseline readings, taking into account the typical changes in visual performance that occur throughout the day, particularly after prolonged exposure to a screen.

To evaluate the impact that various beverages have on visual metrics, the researchers utilized a novel methodology. The participants were given 100 millilitres of three different beverages—milk, coffee, and tea—on three successive days that were consecutive to one another. The purpose of this research was to investigate the possibility of alterations in visual metrics following the ingestion of numerous beverages. To establish a comparison reference point, baseline readings were acquired before the consumption of beverages. Following the consumption of beverages, the subsequent evaluations of visual parameters were carried out at two distinct time intervals: thirty minutes and one hour. Using this strategic approach, we were able to investigate any immediate or short-term effects that the beverages that were ingested had on visual performance indicators after prolonged laptop use. This allowed us to examine temporal effects. The precise approaches that were utilized to evaluate visual parameters were standardized and performed in accordance with the protocols that have been developed in the field of optometry. To determine contrast sensitivity, the Freiburg visual acuity test, [9] often known as FrACT, was utilized. [10] To locate the near point of accommodation (NPA), the push-up method was utilized in conjunction with an RAF ruler. [11] Finding the near point of convergence (NPC) was accomplished through the use of the penlight method. [12] With regard to the evaluation of visual acuity, the log MAR chart was utilized. Additionally, a standardized colour-blind test was utilized to evaluate the subject's colour vision.

After carefully gathering all of the information, it was then entered into Microsoft Excel in a methodical manner so that it could be organized in a systematic manner and then analysed. A statistical analysis was carried out with the assistance of the SPSS 21.0 program. The data were subjected to conventional analysis techniques to verify that they followed a normal distribution before any additional analysis was carried out.

The subsequent analysis of the data consisted of a number of processes, one of which was descriptive statistical analysis, which was used to determine the variances and means in visual parameters that occurred after the ingestion of various beverages, respectively. The multivariate analysis of variance (MANOVA) was employed to compare the means of the three beverages with regard to particular visual criteria. In addition, a simple linear regression analysis was carried out to investigate and quantify the potential temporal impacts that various beverages could have on the range of visual metrics that were assessed.

## Results:

Twenty female participants were included in the study. The average age of the study cohort was 20.6 years ± 0.753. Baseline readings for coffee, tea, and milk consumers were collected at approximately 7.34 p.m., 9.30 p.m., and 9.51 p.m., respectively. Table 1 illustrates the mean values of various visual parameters at baseline and 30 minutes post-consumption of coffee, tea, and milk.

A statistically significant increase in contrast sensitivity was seen from 1.60 logs at the start to 1.75 logs after 30 minutes of coffee consumption ($P = 0.026$; 95% CI 0.018–0.27) by Multivariate Analysis of Variance (MANOVA). However, there was a noteworthy decline in contrast sensitivity from 1.75 logs at the 30-minute mark to 1.59 logs after 60 minutes ($P = 0.016$; 95% CI 0.03–0.028). This trend is illustrated in Figure 1A, which depicts an initial increase in contrast sensitivity following thirty minutes of coffee intake, subsequently returning to levels akin to the baseline after sixty minutes. A clear decrease in the ability to recover near-point of convergence (NPC) was observed while using the red filter after consuming coffee. There was a significant decrease from the initial measurement (10.40cm) to the measurement taken after 30 minutes (10.55cm) ($P = 0.000$, 95% CI 1.83–3.87). Furthermore, a significant drop in measurement was noticed after consuming coffee, namely from the 30-minute mark (10.55cm) to the measurement taken after 60 minutes (10.78cm) ($P = 0.000$, 95% CI 2.21–4.25). The values closely approximated the initial readings and are visually represented in Figure 1B. Table 2 presents the important factors associated with coffee intake within the 30- and 60-minute periods after the initial measurement. Although there were changes in other variables after drinking a beverage for 30 and 60 minutes, these changes were not statistically significant.

A Multivariate Analysis of Variance (MANOVA) was performed to examine the average differences in coffee, tea, and milk intake between baseline and 30 minutes, 30 minutes and 60 minutes, and baseline and 60 minutes, respectively. The results from Figures 2A and 2B indicate a significant difference in NPC with red filter recovery between the start and 30 minutes (P = 0.000, 95% CI 2.22–3.79) and between the start and 60 minutes (95% CI 2.12–3.69) after consuming coffee. However, there were no substantial changes observed in the use of either tea or milk.

By examining the "mean difference" in tea consumption at different time intervals (baseline to 30 minutes, 30 minutes to 60 minutes, and baseline to 60 minutes), a significant change in colour vision deutan (P = 0.034, 95% CI 0.06–1.44) during the 30-to-60-minute period with tea consumption was observed. However, there was no noticeable alteration in the intake of coffee and milk, as depicted in figures 3A and 3B. Table 3 presents the important factors linked to the consumption of coffee and tea within the 30 and 60-minute periods from the initial measurement. No statistically significant alterations were seen in visual acuity, near point of accommodation (NPA), or NPC break between the baseline and 60-minute mean values. Applying simple linear regression to assess the influence of each beverage on the starting state, as well as the 30th and 60th minutes following intake, indicated that none of the beverages had a statistically significant impact ($p > 0.05$).

## Discussion:

This study aimed to explore diverse visual characteristics and the effects of three distinct beverages following prolonged laptop use, given previous indications that extended laptop exposure may induce visual fatigue. [11] Despite assessing various aspects such as visual acuity, contrast sensitivity, colour vision, accommodation, and convergence, statistically significant differences were primarily observed in contrast sensitivity, convergence recovery using a red filter, and colour vision specifically related to the deutan subtype. Subsequent to consuming coffee for both 30 and 60 minutes, there was a significant alteration in contrast sensitivity (1.60, 1.75, and 1.59) with P-values of 0.026 and 0.016. Similarly, convergence recovery using a red filter (10.40, 10.55, and 10.78) demonstrated substantial significance after 30 and 60 minutes of coffee intake, reporting a P-value of 0.000. In comparison to milk or coffee intake, there was a notable difference in the mid-range of colour vision, specifically in the deutan subtype (1.05, 0.43, and 0.43) (P = 0.034). Notably, earlier studies found that the wavelength of tea pigments that stimulated deutan subtype colour vision was 514.5 nm at room temperature. [12] This matches up with more recent research that showed drinking tea significantly improved deutan-subtype colour vision compared to drinking coffee or milk. When comparing the consumption of tea to coffee or milk, it was observed that the initial deutan and tritan values (2.15, 1.50, and 1.30) significantly rose after consuming tea. While the consumption of coffee (2.0, 2.05, and 1.83) and milk (1.23, 1.18, and 0.98) resulted in an enhancement of the Tritan value, there was no statistically significant alteration seen. Following one hour of consumption, the deutan value exhibited an increase in the presence of coffee; yet, it experienced a further reduction in the presence of milk. Similarly, the baseline contrast sensitivity levels were lower compared to the levels observed after consuming coffee and tea. On the other hand, the baseline values were initially better but decreased after consuming milk. Following a 30-minute period of consuming coffee, there was a noticeable enhancement in contrast acuity. However, after one hour, the measurements had reverted back to their initial levels, suggesting that the benefit was just temporary.

The primary elements that influence contrast sensitivity are spatial brightness, texture, movement, colour, and binocular disparity. [13] Previous studies have indicated that the modest neurostimulant effects caused by usual dietary quantities of coffee alter the release of dopamine. [14] This phenomenon was discovered to suppress neuronal activity across the whole brain. [15] The diurnal characteristics of vision under conditions of light adaptation and the ability to perceive contrast are contingent upon the presence of dopamine. [16] These ideas elucidate the transient enhancement in contrast acuity that ensues following coffee consumption. Prior studies conducted by Jeff C. Rabin et al. shown a notable enhancement in eyesight and contrast sensitivity when individuals consumed dark chocolate as opposed to milk chocolate. [17] The present study compared the effects of coffee and tea, both of which contain caffeine like dark chocolate. It observed an enhancement in contrast sensitivity but no alteration in visual acuity. These results partially align with the previous study on contrast sensitivity but contradict the findings on visual acuity. This discrepancy may be attributed to the varying caffeine levels in each beverage.

Following tea consumption, there was a noteworthy rise in the amplitude of accommodation by 0.30 D after 30 minutes, which further rose by 0.12 D after an hour, resulting in a total increase of 0.42 D. After ingesting coffee, the amplitude of accommodation increased by 0.17 D. However, after 60 minutes, it reduced by 0.24 D, resulting in an overall decrease of 0.07 D. None of the drinks exhibited a statistically significant difference. However, following a 30-minute consumption of milk, there was a decrease of 0.22 diopters (D), which only slightly improved by 0.09 D after 60 minutes. Overall, there was a loss of 0.13 D, as illustrated in figure 4.

Another study examining the "Impact of coffee (caffeine) on the prevention of human cataract blindness" discovered that persons who consumed a higher quantity of coffee had a reduced occurrence of the condition compared to those who consumed less. [18] This indicates a correlation between the consumption of caffeine and changes in the lens of the eye in people. The current study also discovered a significant increase in accommodation among coffee and tea drinkers compared to milk drinkers; supporting the claim that caffeine intake influences lenticular change.

The beverages had a negative effect on convergence, as seen by a decrease in the near-points of convergence across all three groups. A significant decrease in NPC was observed with coffee drinking, as evidenced by a statistically significant drop (P = 0.000) in NPC measurements. Specifically, there was a decrease in NPC from baseline (10.40cm) to 30 minutes post-consumption (10.55cm), as well as from 30 minutes post-consumption (10.55cm) to 60 minutes post-consumption (10.78cm). Although there was no statistical significance, a noticeable and meaningful decrease in convergence was observed with the red filter after consuming tea, with a reduction of 0.72 cm at the breakpoint and 0.63 cm at the recovery point. Although milk consumption led to a decrease in NPC, the decline was neither clinically or statistically significant.

Tea primarily contains two key components: caffeine and L-theanine. [19] An electroencephalogram (EEG) showed that consuming L-theanine reduced activity in the sympathetic nervous system. [20] Altering the levels of dopamine and serotonin in the brain induces a calming effect and reduces the activity of the sympathetic nervous system, leading to a state of relaxation and heightened awareness. [21] The sympathetic nervous system's impact, which encourages ciliary muscle tonicity while stimulating pupil dilation, explains the increased amplitude of accommodation following tea consumption. [22] While coffee consumption led to an increase in the amplitude of accommodation, the rise was greater when consuming tea. The reduction of impulses transmitted through the short ciliary nerves, which connect the post-ciliary ganglia to the oculomotor neurons, leads to pupil dilation. This, in turn, causes a decrease in the contraction of the medial rectus muscle and ultimately affects the near point of convergence. [23]

After consuming milk, all visual measurements that were shown to be significantly improved or diminished by coffee and tea consistently declined. Tryptophan, an amino acid included in milk, is believed to play a role in the synthesis of serotonin, a neurotransmitter that aids in sleep promotion and attention reduction. [24] The current study excluded the measurement of intraocular pressure (IOP) as one of the variables to be examined due to the existence of several studies exploring the relationship between coffee

drinking and alterations in IOP. [8, 25-27] All of these previous trials incorporated either coffee or other drugs containing caffeine. Tea was excluded from the study; therefore, it is imperative to investigate the impact of tea on IOP levels. The study's constraints include the potential for a more comprehensive understanding of beverage effects on visual metrics with a larger sample size. Furthermore, the study did not evaluate tear film changes, corneal curvature modifications, axial length fluctuations, and other pertinent parameters that could exhibit significant alterations with each beverage, particularly following extended laptop use.

## Conclusion:

This study delineates the transient effects of coffee and tea on visual parameters, showing temporary improvements in contrast sensitivity and colour vision within 30 minutes, subsiding after 60 minutes. Both coffee and tea induced a clinically significant increase in accommodation amplitude while causing a regression in near-point convergence, contrasting with milk consumption, which led to decreased visual parameters due to tryptophan's presence inducing drowsiness.

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Conflict of interest: None

## References:

1. Rosenfield M. (2016). Computer vision syndrome (aka digital eye strain). *Optometry*. Feb 16;17(1):1-0.
2. George SE, Ramalakshmi K, Mohan Rao LJ. (2008). A perception on health benefits of coffee. *Crit Rev Food Sci Nutr*. May 8; 48(5):464-486.
3. Ferruzzi MG. (2010). The influence of beverage composition on delivery of phenolic compounds from coffee and tea. *Physiol Behav*. Apr 26;100(1):33-41.
4. Arab L, Liu W, Elashoff D. (2009). Green and black tea consumption and risk of stroke: a meta-analysis. *Stroke*. May 1;40(5):1786-1792.
5. Ding M, Bhupathiraju SN, Satija A, van Dam RM, Hu FB. (2014). Long-term coffee consumption and risk of cardiovascular disease: a systematic review and a dose–response meta-analysis of prospective cohort studies. *Circulation* Feb 11;129(6):643-659.
6. Bhupathiraju SN, Pan A, Malik VS, Manson JE, Willett WC, ET. ALL., (Caffeinated and caffeine-free beverages and risk of type 2 diabetes. *Am J Clin Nutr*. Nov 14;97(1):155-166.
7. Hu G, Bidel S, Jousilahti P, Antikainen R, Tuomilehto J. (2007). Coffee and tea consumption and the risk of Parkinson's disease. *J Mov Disord*. Nov 15;22(15):2242-2248.
8. Chandrasekaran S, Rochtchina E, Mitchell P. Effects of caffeine on intraocular pressure: the Blue Mountains Eye Study. J Glaucoma. 2005 Dec 1;14(6):504-507. December 2005 - Volume 14 - Issue 6 - p 504-507
9. Lange C, Feltgen N, Junker B, Schulze-Bonsel K, Bach M. (2009). Resolving the clinical acuity categories “hand motion” and “counting fingers” using the Freiburg Visual Acuity Test (FrACT). *Graefes Arch Clin Exp Ophthalmol*. Jan 1;247(1):137-142.
10. Ventola CL. (2014). Mobile devices and apps for health care professionals: uses and benefits. Pharm. Ther. May;39(5):356.
11. Shantakumari N, Eldeeb R, Sreedharan J, Gopal K. (2014). Computer use and vision. related problems among university students in Ajman, United Arab Emirate. *Ann Med Health Sci* Res;4(2):258-263.
12. Cheung YM, Gayen SK. (1994). Optical nonlinearities of tea studied by Z-scan and four-wave mixing techniques. *J Opt Soc Am* B Apr 1;11(4):636-643.
13. Souza GD, Gomes BD, Silveira LC. (2011). Comparative neurophysiology of spatial luminance contrast sensitivity. *Psychol Neurosci*. Jun;4(1):29-48.
14. Addicott MA, Laurienti PJ. (2009). A comparison of the effects of caffeine following abstinence and normal caffeine use. *Psychopharmacology*. Dec 1;207(3):423-431.
15. Nehlig A, Daval JL, Debry G. Caffeine and the central nervous system: mechanisms of action, biochemical, metabolic and psychostimulant effects. Brain Res. Rev 1992 May 1;17(2):139-170.
16. Jackson CR, Ruan GX, Aseem F, Abey J, Gamble K, Stanwood G, Palmiter RD, Iuvone PM, McMahon DG. Retinal dopamine mediates multiple dimensions of light-adapted vision. J Neurosci 2012 Jul 4;32(27):9359-9368.
17. Rabin JC, Karunathilake N, Patrizi K. Effects of milk vs dark chocolate consumption on visual acuity and contrast sensitivity within 2 hours: a randomized clinical trial. JAMA Ophthalmol. 2018 Jun 1;136(6):678-681.
18. Varma SD. Effect of coffee (caffeine) against human cataract blindness. Clin Ophthalmol (Auckland, NZ). 2016; 10:213.
19. Rizwan A, Zinchenko A, Özdem C, Rana MS, Al-Amin MM. The effect of black tea on human cognitive performance in a cognitive test battery. Clin Phytoscience. 2017 Dec 1;3(1):13.
20. Ozeki M, Rao TP, Juneja LR. Factors that affect the body’s nervous system: Relaxation effects of tea l-theanine. In Nutraceutical Proteins and Peptides in Health and Disease. CRC Press. USA 2005, pp. 378-391
21. Yoto A, Motoki M, Murao S, Yokogoshi H. Effects of L-theanine or caffeine intake on changes in blood pressure under physical and psychological stresses. J. Physiol. Anthropol 2012 Dec 1;31(1):28.
22. Abokyi S, Owusu-Mensah J, Osei KA. Caffeine intake is associated with pupil dilation and enhanced accommodation. Eye. 2017 Apr;31(4):615-619.
23. Dragoi V. Oculomotor system. In Neuroscience online electronic book. Sec 3, Chapter 7, UT Health, USA: 2020
24. Nongonierma AB, FitzGerald RJ. Milk proteins as a source of tryptophan-containing bioactive peptides. Food funct. 2015;6(7):2115-2127.
25. Buckingham T, Young R. The rise and fall of intra-ocular pressure: the influence of physiological factors. Ophthal Physl Opt 1986 Jan;6(1):95-99.
26. Okimi PH, Sportsman S, Pickard MR, Fritsche MB. Effects of caffeinated coffee on intraocular pressure. Appl Nurs Res. 1991 May 1;4(2):72-76.
27. Li M, Wang M, Guo W, Wang J, Sun X. The effect of caffeine on intraocular pressure: a systematic review and meta-analysis. Graefes Arch Clin Exp Ophthalmol. 2011 Mar 1;249(3):435-442.